

Electric Bus Adoption on Non-Urban Stage Carriage Routes

Gap Assessment Report

Exploring the Role of Private Sector as a Catalyst for Accelerating Transition to E-Bus in India.



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1. Background

A study titled “Exploring the role of the private sector as catalyst for accelerating transitions of E-Bus in India”, has been undertaken as a joint effort by S G Architects (SGA) and knowledge partners for the study: Council of Energy Environment and Water (CEEW) and Institute of Transportation and Development Policy (ITDP) India. The aim of this study is to help iron out any bottlenecks in accelerating electrification of buses operating under State Transport Undertakings (STUs) and State Transport Authority (STA) Permits on non-urban routes and remove any doubts on viability of such vehicles for a win-win situation for both the industry and the government. This study has been undertaken in five states in India, including Kerala, Ladakh, Madhya Pradesh, Tamil Nadu, and Uttar Pradesh.

This study was undertaken in three broad stages. The first stage documented the findings from interactions with operators, to identify the gaps and bottlenecks in electrification of stage carriage buses on non-urban routes, especially by private operators. The second stage involved a deep dive into identifying viability gap for operating electric buses on such routes by the operators. This involved data collection on specific routes, developing business models for different electric bus models on such routes and undertaking pilots (on select routes) and deriving findings on the performance of buses. The third stage involved consolidating these findings to identify policy gaps and develop policy recommendations that can help achieve the aim of this study.

This piece includes the findings from the first stage of the study. This covers findings from focus group discussions (FGDs) and one on one meetings with 18 different operators in five states. These include both public and private operators. Discussions and one on one meetings were structured around a list of questions (Annexure 1 – Gap Assessment Questionnaire). The answers against these questions were analysed to derive findings

2. Approach and Methodology

A total of 24 operators were contacted to make an assessment on gaps in electrification on non-urban routes. Of these 22 were private operators and two were public operators (UPSRTC and JKSRTC - through SIDCO in Ladakh). Three private operators represented different associations. A list of these operators is presented in Table 1.

Table 1: List (Public/Private) Operators

S.no	Geography	Based at	Operator	Name	Contacts	Facilitated by
1	UT of Ladakh	Leh	Public	Mr. Irfan (JKSRTC)	9906674007	BITES Ltd. and SGA
		Leh	Private	Mr. Dorje, President - Private big bus association cooperative of Leh	9906262921	BITES Ltd. and SGA
		Kargil	Private	Mr. Ijaz Ali	9622331226	BITES Ltd. and SGA
		Kargil	Private	Mr. Mohammad Hanif	8494007390	BITES Ltd. and SGA
		Kargil	Private	Mr. Mohammad Parvez	6005496954	BITES Ltd. and SGA
2	Tamil Nadu	Chennai	Private	Mr. Dharmaraj (President BOCI for Tamil Nadu)	9487677777	ITDP and SGA
		Chennai	Private	Dr A. Anbalagan - President, Alagappa Travels, OMNI Bus Association	Na	ITDP and SGA

S.no	Geography	Based at	Operator	Name	Contacts	Facilitated by
		Chennai	Private	Mr D Sugumar - PRR Travels, Staff Bus Association	Na	ITDP and SGA
		Chennai	Private	Mr V. Senthil Kumaran - Garuda Logistics Pvt. Ltd., Chairman -BOCI, TN	Na	ITDP and SGA
		Chennai	Private	Mr MJ. Suresh - CEO, Pegasus/ Praveen Travels	Na	ITDP and SGA
3	Madhya Pradesh	Dewas	Private	Vishwas transport service - Mr. Pranay & Mr. Vijay Goswami	9425047636	SGA
		Dewas	Private	Earth connects - Mr. Jitendra Rathore	9755133252	SGA
		Dewas	Public	Mr. Pradeep Soni (SDM, DCTSL - Dewas) and Mr. Surya Prakash Tiwari (City Bus Official -DCTSL)	9806888808 and 9424673303	SGA
4	Uttar Pradesh	Luckno w	Private	Mr. Shubham Verma	9161420774	SGA
		Luckno w	Private	Mr. Vinay Verma	9670939517	SGA

S.no	Geography	Based at	Operator	Name	Contacts	Facilitated by
		Lucknow	Private	Mr. Zuhair Khan, Owner and MD, Bharat Bus Service	Na	CEEW
		Lucknow	Private	Mr. Pankaj Mishra, Owner and MD, Mishra tourist bus service	Na	CEEW
		Lucknow	Private	Mr. Tahir Khan, Owner and MD, Zia bus service	Na	CEEW
5	Kerala	Kochi	Private	Mr. Rijas	9020677666	SGA
		Kochi	Private	Ernakulam Private bus association	NA	CEEW
		Kochi	Private	Idukki Private Bus Association	NA	CEEW
		Kochi	Private	Kottayam Private Bus Association	NA	CEEW

A questionnaire was designed for private operators, to gather insights on gap in electrification of non-urban routes. A mix of strategies were deployed to gather gap assessment data for electrification by both public and private operators in the five partner states. These strategies included one on one meetings, with or without a survey (questionnaire based) format, focus group discussions and roundtables. The team tried to gather insights on the following five topics:

1. Potential for electrification by private operators on current routes
2. Level of awareness on the benefits of electrification
3. Perception on challenges in electrification or in using electric buses (financial, operational, etc.)
4. Permit limitations/challenges

5. Assessment of levers/actions that can help accelerate electrification by private operators in that geography

Operators common in a geography had similar perception and assessment of bottlenecks and gaps in electrification. This is in part due to the common permit conditions and rules. Table 2 Presents geography wise breakdown of these gaps by different topics/categories. The findings from these assessments have been presented in the subsequent chapter.

Table 2: Identified Gaps – Geography wise

	Kerala	Ladakh	Madhya Pradesh	Tamil Nadu	Uttar Pradesh
Potential for electrification by private operators on current routes	Private operators are interested in electric buses.	Operators are open to electric buses but have concerns around their applicability especially because routes connect remote areas many of which may not have reliable electricity supply. Under these conditions investing a significant sum in a nascent technology is not seen very prudent.	Operators are not so enthusiastic about electric buses and will buy any bus type (including electric) for which adequate subsidies/grants are available. The current diesel buses were bought under 40% grant as part of AMRUT programme.	Operators are seriously considering electric buses to counter the volatility of diesel prices, and because there is pent up demand to replace their ageing fleet. They are actively seeking answers on the potential pathways towards electrification of bus operations	Operators are citing a reducing market due to nationalisation of routes and very high capital cost as a hindrance to electric bus adoption.
Level of awareness on the benefits of electrification	KSBL has one plus year experience with electric buses. Other operators are aware of the electric bus operational cost benefits.	Operators are aware of e-bus technology and benefits, especially that of low dependence on fossil fuels. They have witnessed the operations of these buses in Ladakh by JKSRRTC (to be transferred to SIDCO). Operators are not confident that these buses can cater to passenger requirements of connectivity to remote towns. They are	Operators do not consider electric buses to be a motivator for passengers as commuters are only looking to complete the journey at the lowest fare. Any potential benefits to operators are not clear as there isn't much experience with e-buses. However, it is considered essential to uplift the image of public transport and reduce	Operators feel that the passengers will benefit from higher comfort offered by new technology buses. They also feel that it is essential to reduce pollution but are concerned about safe recycling of batteries. Operators are aware that electric buses lead to significantly lower operational cost. However, they were not aware if it is enough	Operators are aware of the benefits of these buses in terms of comfort, reduced pollution, and lower operational costs.

		however aware of the contribution to pollution reduction by these buses	pollution.	to offset the high upfront capital cost.	
Perception on challenges in electrification or in using electric buses (financial, operational, etc.)	High capital cost is a concern. Lack of level playing field for the private operators is hindrance for the private operators.	High cost of buses and nascent technology with no past experience (by operators, drivers and maintenance staff) of operating e-buses are cited as major bottlenecks. Other perceived challenges include performance in extreme cold conditions, and the ruggedness of vehicles (sensitive electronics are used) to handle rough terrain and uneven roads/driving surfaces.	The predominant challenge is overcoming the uncertainties associated with a nascent technology. This raises questions on its reliability in operations (especially in terms of effective range) Also the high capital cost in the absence of subsidies to operators especially on non-urban routes, makes it difficult to be considered against diesel buses. Another challenge includes charging time involved. Current operations involve limited layover time which may not be sufficient for opportunity charge.	Challenges include high upfront capital cost, availability of charging infrastructure, loans are not available for long duration plus high interest rates make long duration loans unviable. Additional challenges include lack of customization options and limited seats, as current models are designed for urban specifications (more standing)	Lack of routes and very high capital cost remains the most cited challenge. Furthermore, lack of charging infrastructure and parking facilities, clubbed with range anxiety on the model is also seen as a barrier to e- bus adoption.

<p>Permit limitations/challenges</p>	<p>There is no permit required to operate electric buses. Currently a large number of permit holders are not operating buses on stage carriage routes.</p>	<p>The permits in Ladakh are issued by the RTO. The private operators apply for these permits through their association (Ladakh Big Bus Association). Operators pay a fixed annual fee to the association, which in turn arranges for the renewal of permits. Currently the annual permit renewal is stalled because the registration of the buses on Ladakh registration system (LA numbers) is underway.</p>	<p>Permit is provided by DCTSL, but permit fees are paid by the operators. Permit fees are high and acquiring a permit is a long and tedious process, in many cases newly purchased buses remain in operational for months waiting for a permit. Acquiring permits for electric buses can be an equally challenging process.</p>	<p>No new permits are being issued, only holders of older permits can ply buses. Permit conditions stipulate the service schedule/ layover time, number of daily trips, fare conditions, occupancy, etc. The currently stipulated fare is Rs. 0.58 per/km and the maximum occupancy allowed is 100%. Additionally permits are only issued for routes with length less than 120km.</p>	<p>Majority of stage carriage operations in the Lucknow division has been nationalised to be operated by the STU only. Furthermore, new route permits are not being issued, or are being issued in batches for which a smaller private operator, plying 4-5 buses, is not eligible.</p>
<p>Assessment of levers/actions that can help accelerate electrification by private operators in that geography</p>	<p>Helping the KSBL to aggregate the demand for the electric buses and financial models to overcome the capital cost burden. Better regulatory framework to create a level playing field for the private operators.</p>	<p>Reduced bus cost along with reduced interest rates coupled with longer loan tenure are considered among the most effective levers in accelerating adoption of buses in Ladakh. This is followed by better access to parking/ charging infrastructure and maintenance facilities. Cheaper electricity charges and greater range are considered the least important levers.</p>	<p>Higher range and lower interest rate (or low capital cost) is considered as the most important lever for accelerating electrification. This is followed by options of longer loan tenure and availability of parking and charging infrastructure. Access to maintenance facilities and cheaper electricity cost is considered the least important levers</p>	<p>Higher range and lower interest rate (or low capital cost) is considered as the most important lever for accelerating electrification. This is followed by assured accessibility to parking and charging infrastructure and maintenance facilities. Longer loan tenure and cheaper electricity charges are considered the least important levers.</p>	<p>Newer and longer route permits must be issued to private operators without restriction on fleet size. Lower capital cost on e-buses, coupled with access to parking and charging infrastructure. Furthermore, rising insurance costs were raised as a concern.</p>

3. Gap Assessment Findings

The meetings conducted as a part of the gap assessment process revealed both potential and limitations in electrification of the current fleet of buses by private operators in five geographies. The findings from these interviews have been summarised below. These can be used in framing of regulatory framework and policy making with an objective of accelerating adoption of electric buses in India.

3.1 Policy Limitations

It has been observed that in all five states private operators are less confident in locking large capital in a relatively untested and yet evolving technology. This is also due to the fact that there is very little operational experience for operating these buses on non-urban routes in general and privately operated non-urban routes in particular. This is in part because current available bus models and subsidy programmes are designed for urban operations. Also, the current support extended through aggregation of demand by CESL, as well as most state electric vehicle policies are focussed on incentivising State Transport Undertakings (STUs) or public operators and not private operators.

3.2 Product Limitations - lack of interest by OEMs

Due to lack of experience and information (in public domain) on electric bus operations on non-urban routes, operator's concerns on effective operational range, life of the vehicle, battery life, etc., remain unaddressed. Additional concerns are around OEM's willingness to cater to electric bus demand from private operators. This reflects in the lack of interest by the OEM sales teams, dealer networks etc. to offer electric buses to private operators and address any concerns/questions around it. The general lack of interest in catering to electric bus demand on non-urban routes also reflects in the absence of models with high seating capacity and luggage storage, which are specific requirements for such routes¹. This lack of interest from electric bus manufacturers towards this select category of operators means that operations by current diesel bus remain the only viable option even with increasing fuel prices. Further, Diesel bus OEMs are offering additional features and the options of customisation, which is essential for private operators to stand apart from competition - this is missing for electric buses.

OEMs do not offer clarity on after sales support requirements for electric buses. How can the operators access service and maintenance facilities? Are their service centres close by? What is the service/maintenance cycle/requirement? How much will it cost? How long will each visit to the service centre take? These are some of the questions, answers to which impact the business viability of electric buses for the private operators. OEMs are currently not offering such standalone service facilities that can be accessed by private operators. They need to plan for this future and share these plans with the operators if acceleration of e-bus adoption is to be achieved in the country.

¹ Permit conditions do not allow standing on non-urban routes, and hence buses with low number of seats offer reduced capacity and thus reduced earning potential.

3.3 Financing Limitations

All private operators agree that increasing fossil fuel prices are making ICE buses operations unviable and hence the future lies with transitioning to an electric bus fleet. Most operators have an ageing fleet of buses because all plans for upgrading the fleet did not materialise and were put on the back burner during the pandemic. There thus exists a large pent-up demand which must be met. This can translate to accelerated electric bus adoption given the right environment for private operators. But there are limited ownership options available for electric buses. The only available option for private operators is an ownership model. The high capital cost of a bus means that the ownership model is dependent on commercial financing.

All financing products both by banking and non-banking institutions are designed for diesel buses and specific products for electric bus financing are missing. This is essential because of the huge difference in the structure of the total cost of ownership (TCO) for the operator. While for Diesel buses, the capital component is low, the operational component is high. It is the reverse for electric buses. This means that while for Diesel buses expenses can easily be spread out throughout the life cycle of the bus and the difference between cost and earning remains uniform throughout the life cycle of the buses, it is not the same for electric buses.

Therefore, for diesel buses, in an ownership model, financing products with short tenure of 4-5 years and relatively higher interest rate (between 8-12%) though reduces the profit for the operators during the loan period, it does not make it a loss-making venture. However, in the absence of any subsidies for private operators, the capital cost of electric buses remains high (between 0.9 to 1.8 crore) thus the same financing product would result in significant losses for the operator during the loan tenure. This even if on an average earning is higher than the cost throughout the service life of the bus. Since private operators usually operate a small fleet of buses (less than 6-10), they are unable to cushion off these losses. To overcome this challenge, financing institutions need to design products that offer low interest rate and long tenures for electric buses.

Additionally, alternate ownership models need to be made available to the operators. These include lease models, that eliminate the need of high upfront investment requiring innovative financing.

3.4 Lack of Experience with Electric Bus Operations

Most operators of buses on non-urban routes cite lack of experience of use of electric buses as an important reason fuelling the doubts on its viability. They seek more information in terms of real-world performance of the buses over a longer period. Operators are concerned about the range limitations of the bus in real world conditions. They understand that the stated range may not be available in operations. However, they are not clear on what products offer what type of real-world range. Additionally, they have concerns on battery life and subsequent battery disposal. They understand that significant capital needs to be re-invested in the bus when the battery needs replacement. However, they are not sure of the quantum or how many times this investment is required during the service life of the bus. They also have concerns on servicing and maintenance of the bus. They have not been able to gain confidence that OEMs will be able to deliver on their warranties as they do not see any promises on availability of trained service staff and workshop conditions in the proximity of their operational area. This points to a need for not just more pilots on non-urban routes targeting both public and private

operators but also greater marketing push by OEMs and planned communication and public outreach campaigns by the government, highlighting the performance of these vehicles.

3.5 Charging Limitations

Most operators are small fleet owners, and it is not viable for them to invest on even slow charging infrastructure. Additionally non-urban routes are longer in length and cannot rely only on charging at the origin. They need fast (to minimise layover time and increase operational time), opportunity charging either enroute or at the destination. These are expensive and require additional land, which means it can only be possible as a public and not a private charging facility (for electric buses). This is not possible to be facilitated by individual private operators and requires investment by the State or a third party in a network of public bus charging infrastructure. However, most states do not address this issue in their plans or their EV policy. Most have not invested heavily on electric vehicle (EV) public charging infrastructure in general to address the range anxiety associated with these vehicles. Bus operators therefore seek a clear roadmap from the government on the availability of fast public bus charging infrastructure and the cost of energy drawn from this infrastructure (to address any doubts that expensive public charging will negate operational cost reduction benefits). Additionally, they seek buses with exceedingly long range.

3.6 Permit Limitations

Private players operate the buses on non-urban (including non-fossil) routes under an annually renewable (for a fee) permit issued usually by regional transport office (RTO) under the State Transport Authority (STA). The existing permit conditions have evolved for internal combustion engine (ICE) based bus operations. The permit conditions can include the following restrictions:

- Ownership restrictions - permit is given specific to a bus and the bus needs to be registered in the name of the person applying for a permit. Therefore, lease models may not be feasible under current permit conditions in many states.
- Operational restrictions - these include restrictions on permissible seating or overall capacity and bus type as well specifications.
- Service restrictions - these restrictions include a timetable that must be adhered to, restricting the flexibility to adjust layover time to meet operational or vehicle challenges.
- Fare restrictions - these include limits on the maximum fare that can be charged to a passenger.

Operators therefore seek more flexibility in permit conditions to adapt to specific requirements of e-bus ownership and operations (such as to meet opportunity charging requirements). Alternately special e-bus permits can be designed and offered to meet these requirements.

Annexure 1 – Gap Assessment Questionnaire

Q.1 Are you considering adding electric buses to your current fleet? Yes, or no?

Reasoning:

Details:

Q.2 What challenges & limitations do you perceive in operating electric buses on your current routes?

Q.3 What are the Pros / Cons in electrification of buses?

<i>From Passenger's perspective:</i>	
<i>From Operator's perspective:</i>	
<i>From Society's perspective:</i>	

Q.4 Which one of these facilities/services will positively contribute to meet your operational requirements towards electrification on non-urban routes? Please rank in the order of preference (1 to 6).

<i>Cheaper Electricity Charges</i>	<i>Parking & Charging infrastructure</i>	<i>Maintenance / Service Facility</i>	<i>Greater Range (km covered)</i>	<i>Lower Financing - Interest Rate</i>	<i>Longer Loan Tenure b/w 5 to 7yrs</i>

Q.5 Any experience of electrification - Any legal / regulatory/ political / social / financial hurdles faced?

Q.6 Please provide details of laws / regulations / financial policies, which you think can accelerate the adoption of electric buses by private operators on non-urban routes.

Q.7 Even with FAME subsidies and clear benefits without it, both private and public bus operators have thus far shown no enthusiasm to invest in non-urban electric bus operations. What are the gaps and limitations in transitioning to e-bus?

<i>Nascent technology</i>	Y/N	
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<i>Range anxiety</i>	Y/N	
<i>Cost of the electric bus</i>	Y/N	
<i>Access to charging related infrastructure (land etc.)</i>	Y/N	
<i>Service network</i>	Y/N	
<i>Lack of vehicle models to meet specific operational</i>	Y/N	
<i>Breakdown / service infrastructure</i>	Y/N	
<i>Charging</i>	Y/N	
<i>Funding schemes</i>	Y/N	
<i>Capital cost of buses & availability of financing opportunities</i>	Y/N	
<i>Discrimination in availability of subsidies</i>	Y/N	
<i>Policy / Regulatory / Financial Implications</i>	Y/N	
<i>Any other reason</i>	Y/N	